

The ROI of Dental Insurance:

Systemic Implications of Oral Disease

Oral Implications of Systemic Disease

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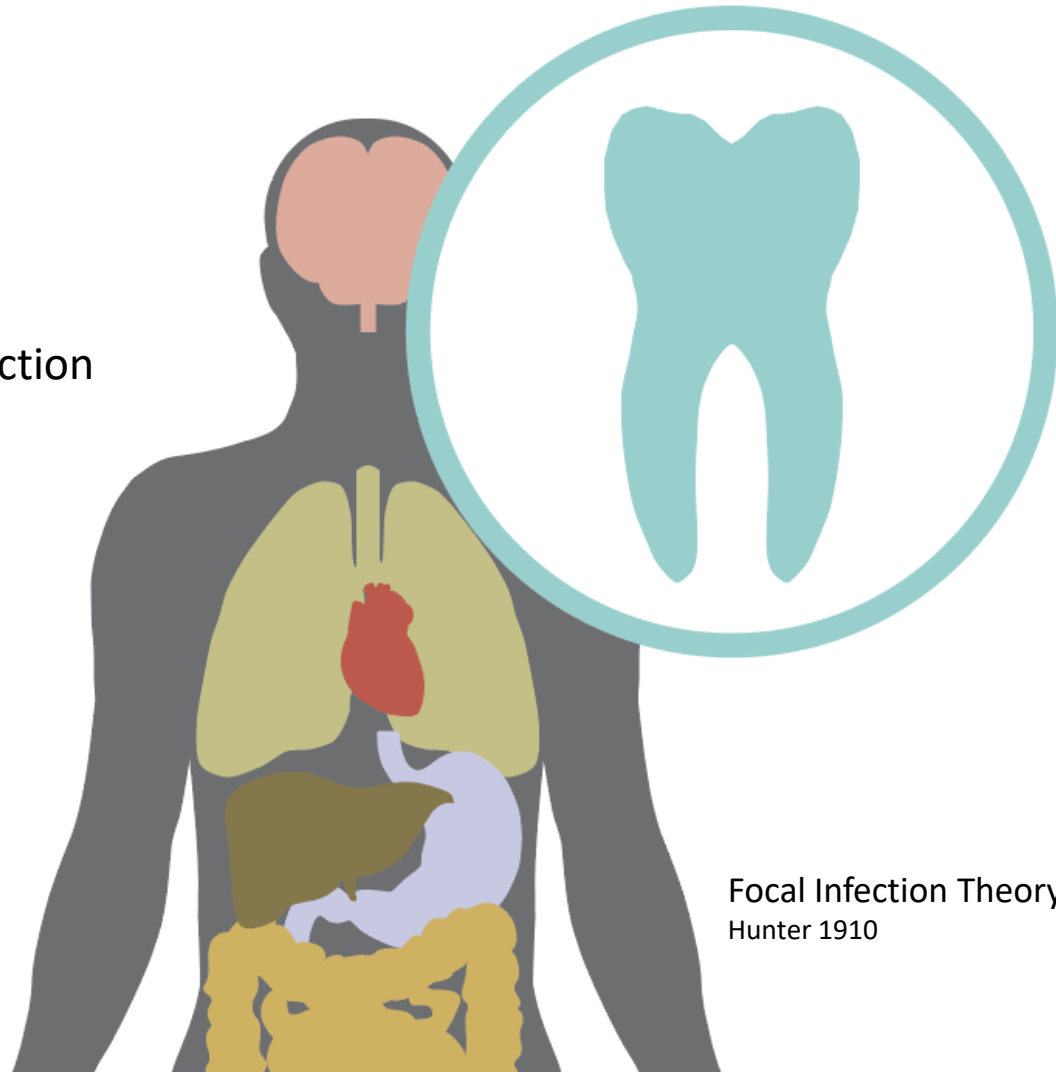
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- No financial interests in any products or techniques in this presentation
- No conflicts of interests

Introduction

- The mouth is anatomically connected to the body
- Pathophysiology of 3 common oral diseases
- Effect of general health on oral health
- Effect of the oral health on general health
- Financial implications (health care dollars)

The Mouth Is Attached to the Body

Hippocrates (460 – 370 BC)
Claimed to have cured arthritis with an extraction



Focal Infection Theory
Hunter 1910

How Do These Oral Problems Affect Your Health?

Periodontitis (Gum Disease)



Caries (Cavities)



Squamous Cell Carcinoma (Cancer)

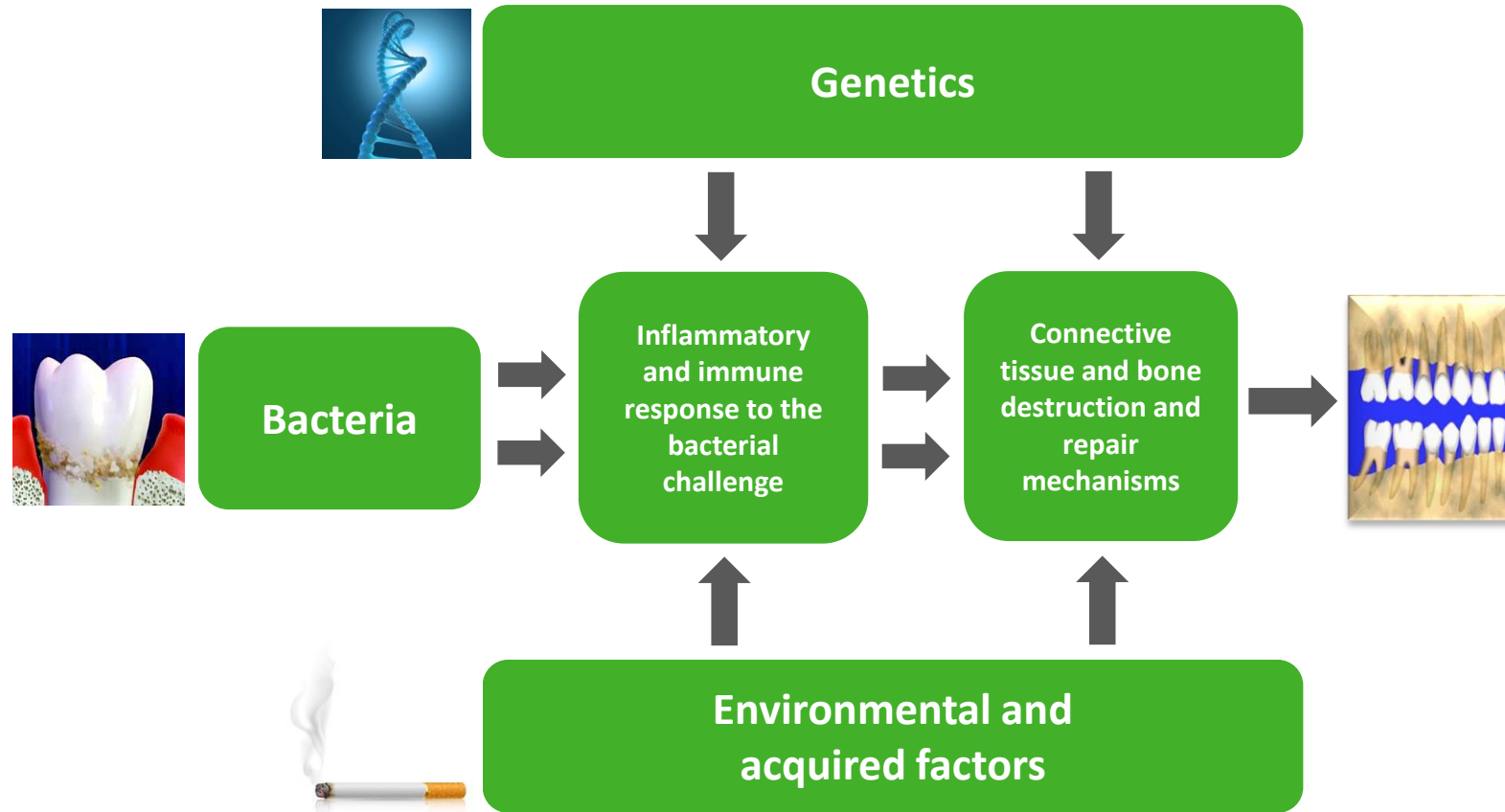


Dental Disease is “Inexpensively” Preventable

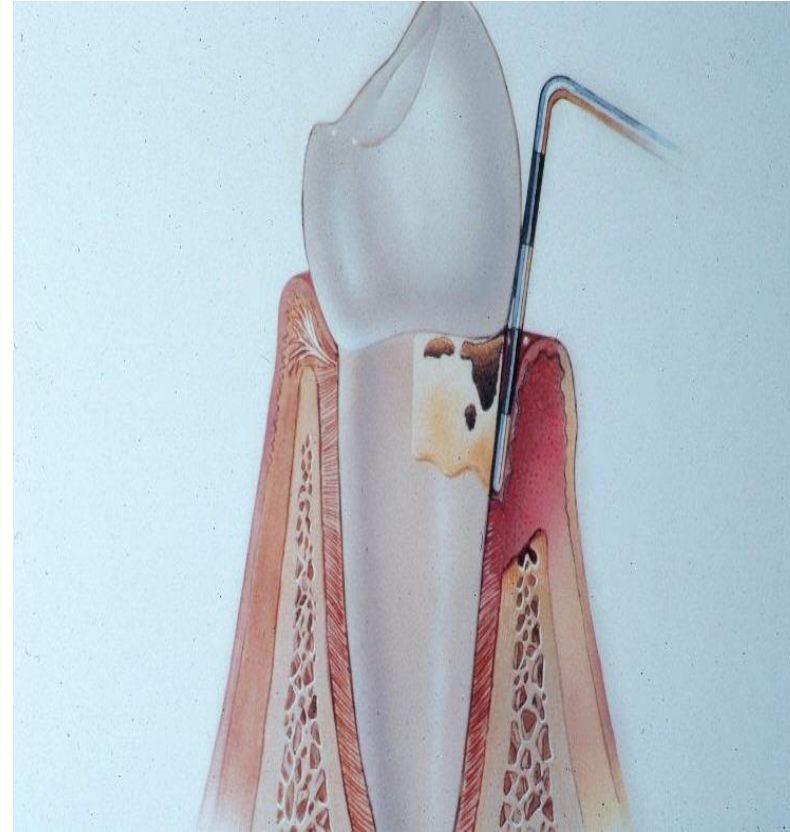
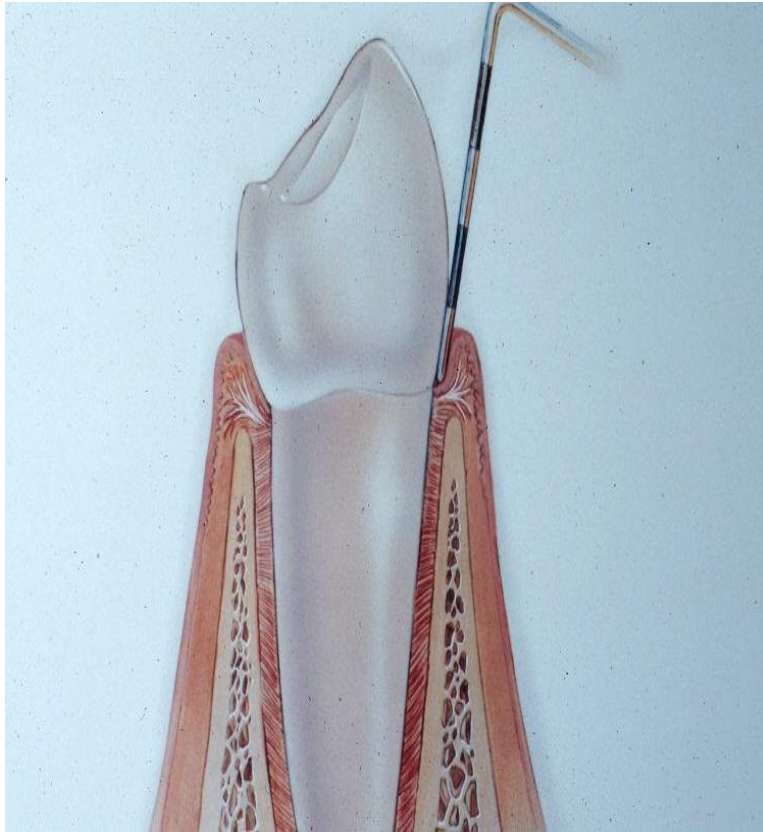
- Brushing/Flossing (gum disease)
- Professional cleanings (gum disease)
- Fluoridated water / supplements (caries)
- Diet
 - Less sugar, volume & frequency (caries)
 - Vitamin C (gum disease: scurvy) (*L:scorbitus* for ascorbic acid, 1753 James Lind)
- Smoking cessation, alcohol moderation, (gum disease, caries, cancer)
- Gardasil HPV vaccine (cancer)
- Mouth guards (trauma)



Periodontitis Is a Multifactorial Complex Disease



Periodontitis (Gum Disease, Pyorrhea)



Surface Area of Ulcerated Tissue

Moderate periodontitis

5–7 mm = 3,810 sq. mm or 6 sq. inches

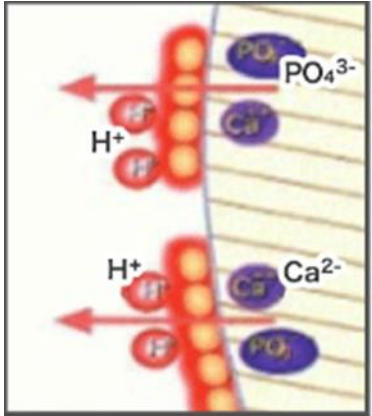


About the same as this ulcer

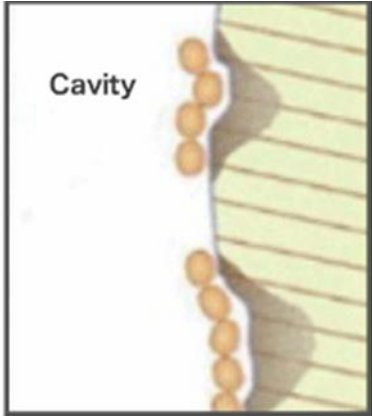
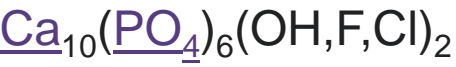
ResearchGate



Caries (Cavity)

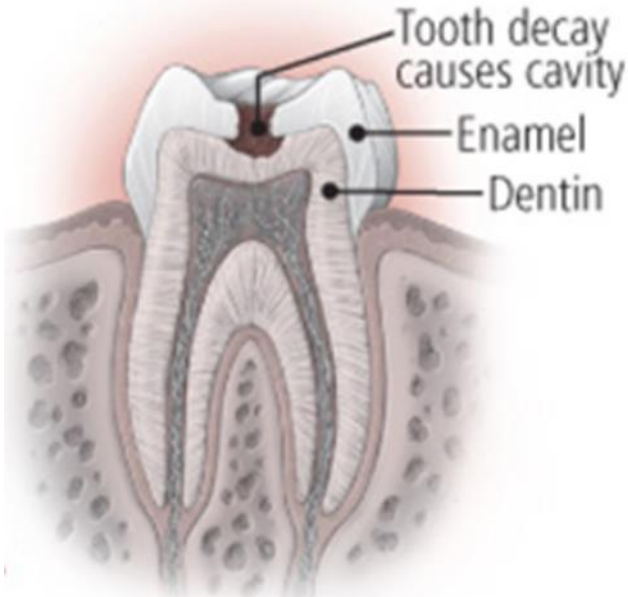


Decalcification due to acid produced by cariogenic bacteria



Cavity formation

Early tooth decay



Cavities Lead to Abscess

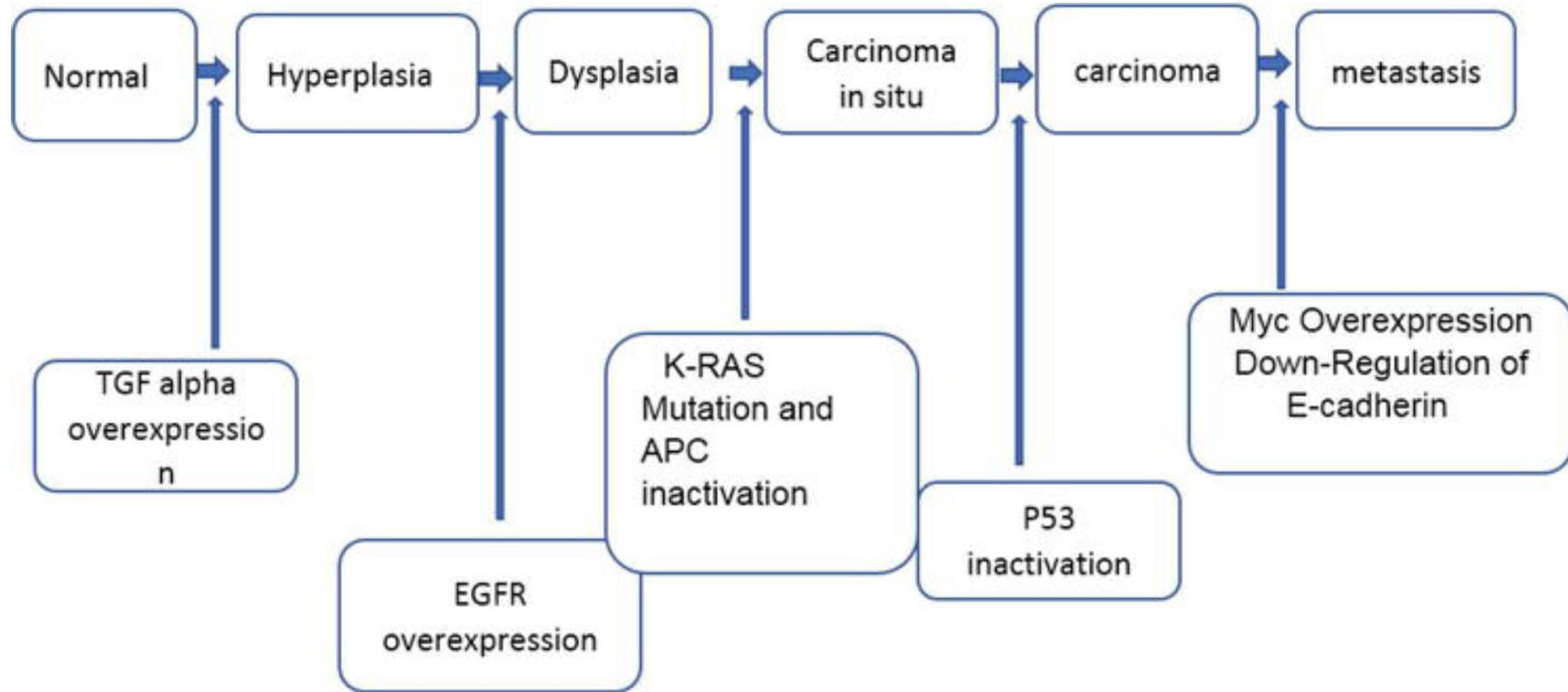


Oral Cancer

- Primary causes: Tobacco use, Alcohol, HPV, Chronic irritation, Sun Exposure
- Sixth most common cancer in the world, 3% of all cancer in USA
- Hypopharynx is the most common primary site, followed by the base of tongue and anterior tongue
- Most common metastatic sites are lymph nodes (80%), lung, heart, bone
- Male predilection (2 X females), > 50 y.o.
- 5 year survival rate is 66% (American Cancer Society)
 - (Same as skin, or cervical cancer)
- 11 per 100,000 each year—increasing since 2004
- 35,540 new cases expected for 2022



Pathogenesis of OSCA



Oral Cancer—Who's At Risk?

Everyone

Why?

- 75% have risk factors (Smoking, chewing tobacco, drinking alcohol)
- 25% of all oral cancer patients do not smoke or drink alcohol
- Fastest growing segment is among young people and women



Why is there so much confusion and misconception about evidence based medicine?

- Misuse of terminology
- Lack of evidence
- Misinterpretation of existing evidence
- Lack of understanding (willful or otherwise) or misuse of the scientific method and statistical analysis
- Emotion based decision making vs scientific and logic based decision making
- Conformational bias vs scientific inquiry

Terminology

- **Association** (connection or combination)
 - Driving a car and going to a dentist
- **Correlation** (two or more attributes vary together)
 - Height and weight
- **Cause and effect** (one results in the other)
 - SARS-COV-2 Coronavirus and COVID-19
 - Koch's Postulates 1884
 - Bacteria is found in diseased animals and not in healthy animals
 - Bacteria must be isolated from a diseased animals and grown in pure culture
 - If you put bacteria in a healthy animal, it becomes ill
 - Bacteria must be re-isolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent
 - *9 Branford Hill criteria (1965)*

Misinterpretation of data: Do carts pull horses or do horses pull carts?



Other things to consider....

- Lack of evidence does not mean lack of affect
- Evidence based vs. science based decisions



Diabetes

- 11.3% of USA population is diabetic, 38% are pre-diabetic (CDC 2022 data)
- 25.2% of Americans age 65 are diabetic! (diagnosed and undiagnosed)
- Chronic inflammation of periodontitis raises need for medications (Insulin)
- Annual cost per patient for diabetes is \$9,601.00
- Control of gum disease: 10% lower medical and pharmacy costs, 19% reduction in diabetic costs
- Indirect costs include:
 - Increased absenteeism (\$3.3 billion)
 - Reduced productivity at work (\$26.9 billion), for those not in the labor force (\$2.3 billion)
 - Inability to work as a result of disease-related disability (\$37.5 billion)
 - Lost productive capacity due to early mortality (\$19.9 billion)



<http://www.diabetes.org/diabetes-basics/statistics/>

<http://diabetes.org/assets/pdfs/basics/cdc-statistics-report-2017.pdf>

<https://www.ncbi.nlm.nih.gov/pubmed/29567642>

<http://dactoolkit.org/wp-content/uploads/2018/03/Economic-Costs-of-Diabetes.pdf>

<http://www.diabetes.org/advocacy/news-events/cost-of-diabetes.html>

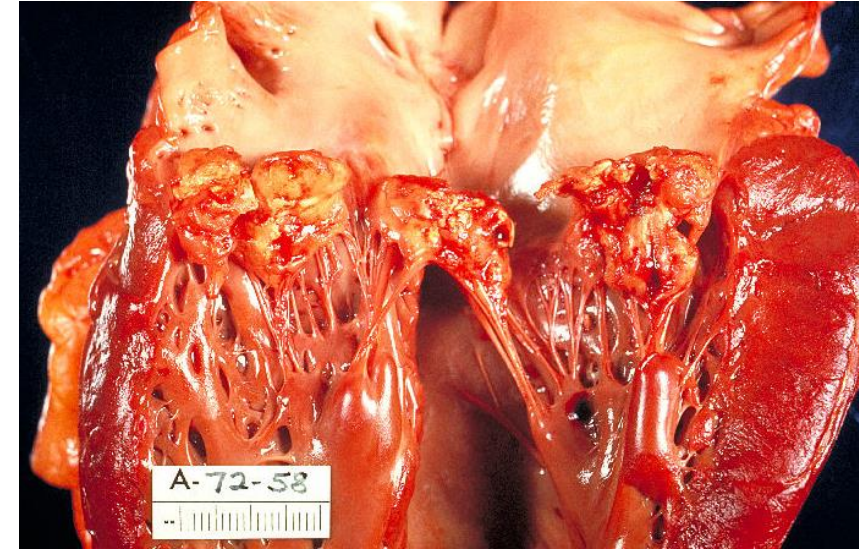
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3609540/>

<https://www.cdc.gov/diabetes/diabetesatwork/plan/costs.html>

<https://www.healthdeals.com/blog/save/diabetes-costs/>

Infective Endocarditis

- Cost \$54,281.00
- 2.7 to 7.9 per 100,000
- Incidence higher in elderly population
- 25% death rate (range 16 – 45%)

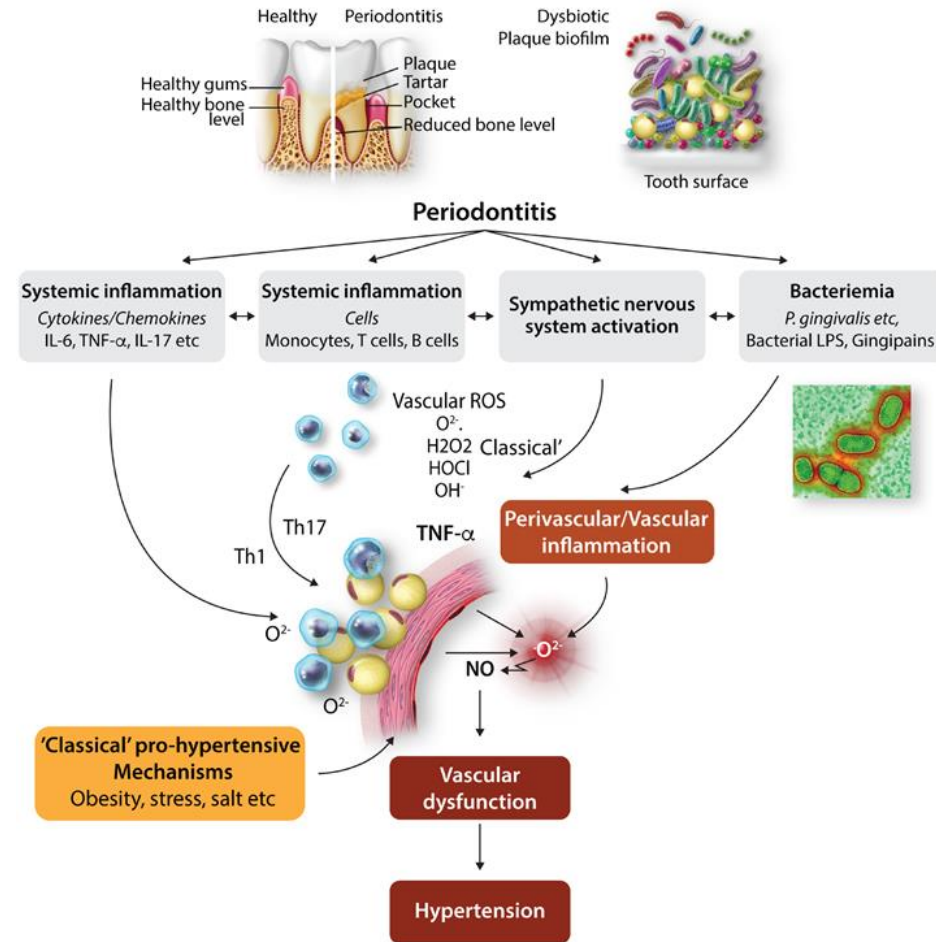


Wikipedia.org

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5015881/>
- <https://www.cdc.gov/mmwr/volumes/66/wr/mm6622a1.htm>
- <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0060033>
- Ambrosioni J, Hernandez-Meneses M, Téllez A, Pericàs J, Falces C, Tolosana JM, Vidal B, Almela M, Quintana E, Llopis J, Moreno A, Miro JM (May 2017). "The Changing Epidemiology of Infective Endocarditis in the Twenty-First Century". Current Infectious Disease Reports. 19 (5): 21. doi:10.1007/s11908-017-0574-9. PMID 28401448.
- Habib G, Hoen B, Tornos P, et al. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). Eur Heart J. 2009;30(19):2369–2413

Periodontitis and Hypertension

Several studies appear to support a relationship between severe periodontitis and hypertension. Limited evidence suggests successful periodontal treatment may improve arterial blood pressure.



Periodontitis is associated with hypertension: a systematic review and meta-analysis

Eva Muñoz Aguilera, Jean Suvan, Jacopo Buti, Marta Czesnikiewicz-Guzik, Aline Barbosa Ribeiro, Marco Orlandi, Tomasz J Guzik, Aroon D Hingorani, Jose Nart, Francesco D'Aiuto

Cardiovascular Research, Volume 116, Issue 1, 1 January 2020, Pages 28–39, <https://doi.org/10.1093/cvr/cvz201>

Prosthetic Joint Infection (PJI)

- Average cost is \$50,822.00
- The incidence of PJI is 1–2.5% for primary hip or knee replacements and 2.1 – 5.8% for revision surgeries
- Treatment of gum disease lowers risk by 31%

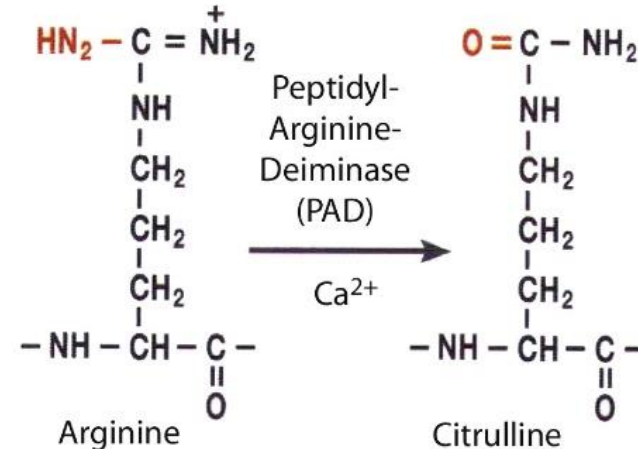


Advancedorthosports.com

- Tai TW, Lin TC, Ho CJ, Kao Yang YH, Yang CY. Frequent Dental Scaling Is Associated with a Reduced Risk of Periprosthetic Infection following Total Knee Arthroplasty: A Nationwide Population-Based Nested Case-Control Study. PLoS One 2016;11(6):e0158096
- Lentino JR. Prosthetic joint infections: bane of orthopedists, challenge for infectious disease specialists. Clin Infect Dis. 2003;36(9):1157–61.
 - Blom AW, Brown J, Taylor AH, et al. Infection after total knee arthroplasty. J Bone Joint Surg Br. 2004;86(5):688–91.
- Blom AW, Taylor AH, Pattison G, et al. Infection after total hip arthroplasty. The Avon experience. J Bone Joint Surg Br. 2003;85(7):956–9. [PubMed]
 - Berbari EF, Hanssen AD, Duffy MC, et al. Risk factors for prosthetic joint infection: case-control study. Clin Infect Dis. 1998;27(5):1247–54.
- <https://www.ada.org/en/science-research/science-in-the-news/frequent-dental-scaling-was-associated-with-decreased-risk-of-periprosthetic-joint-infection>
 - <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1469-0691.2011.03758.x>
- <https://www.ada.org/en/science-research/science-in-the-news/frequent-dental-scaling-was-associated-with-decreased-risk-of-periprosthetic-joint-infection>

Rheumatoid Arthritis

- Periodontitis (gum disease) and Rheumatoid Arthritis (RA) are both chronic inflammatory diseases
- Possible causality between periodontitis and RA. Patients with RA have a higher incidence of periodontal (gum) disease than patients without RA
- Evidence for a positive outcome of periodontal treatment on the clinical features of RA
- Incidence varies by location and race. (40 per 100,000) Michigan 25%, all USA 25%
- 65 years or older, 49.6% ever reported doctor-diagnosed arthritis
- Costs up to \$20,000 annually (Range \$15K to \$36K)
- Treatment of existing gum disease reduces symptoms of RA and decreases costs of medication
- Mechanism involves citrullinated proteins (Arginine to Citrulline conversion by *Porphyromonas gingivalis*)



Evidence is overwhelming

- Mikuls TR, Payne JB, Yu F, Thiele GM, Reynolds RJ, Cannon GW, Markt J, McGowan D, Kerr GS, Redman RS, Reimold A, Griffiths G, Beatty M, Gonzalez SM, Bergman DA, Hamilton BC 3rd, Erickson AR, Sokolove J, Robinson WH, Walker C, Chandad F, O'Dell JR. Periodontitis and Porphyromonas gingivalis in patients with rheumatoid arthritis. Arthritis Rheumatol. 2014 May;66(5):1090-100. doi: 10.1002/art.38348.
- de Smit M, Westra J, Vissink A, Doornbos-van der Meer B, Brouwer E, van Winkelhoff AJ. Arthritis Periodontitis in established rheumatoid arthritis patients: a cross-sectional clinical, microbiological and serological study. Res Ther. 2012 Oct 17;14(5):R222. doi: 10.1186/ar4061.
- Nesse W, Westra J, van der Wal JE, et al. The periodontium of periodontitis patients contains citrullinated proteins which may play a role in ACPA (anti-citrullinated protein antibody) formation. J Clin Periodontol 2012;39:599-607.
- Wegner N, Wait R, Sroka A, et al. Peptidylarginine deiminase from Porphyromonas gingivalis citrullinates human fibrinogen and α -enolase: Implications for autoimmunity in rheumatoid arthritis. Arthritis Rheum 2010;62:2662-2672.
- Menke J. de Smit, Johanna Westra, Elisabeth Brouwer, Koen M.J. Janssen, Arjan Vissink, and Arie Jan van Winkelhoff Commentary: Periodontitis and Rheumatoid Arthritis: What Do We Know? Journal of Periodontology September 2015, Vol. 86, No. 9, Pages 1013-1019, DOI 10.1902/jop.2015.150088 (doi:10.1902/jop.2015.150088).
- Kaur, S., White, S., Bartold, P. M. Periodontal disease and rheumatoid arthritis: a systematic review. Journal of Dental Research. 2013;92(5):399-408.
- Barbour KE, Helmick CG, Boring MA, Brady TJ. Vital signs: prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation — United States, 2013—2015. Morb Mortal Wkly Rep. 2017;66:246–253. DOI: <http://dx.doi.org/10.15585/mmwr.mm6609e1External>
- <https://www.rheumatology.org/Learning-Center/Statistics>
- https://www.humira.com/rheumatoid-arthritis/what-is-rheumatoid-arthritis?cid=ppc_ppd_ggl_ra_bv_reumatoid_arthritis_Phrase_USIMMR180833&msclkid=13193e4204031224899965bcf2be1f38
- <https://www.rheumatoidarthritis.org/treatment/costs/paying-for-treatment/>
- <https://www.arthritis.org/living-with-arthritis/comorbidities/gum-disease/ra-and-gum-disease.php>

Xerostomia

(Dryness of the mouth due to a change in the composition or amount of saliva)

- Xerostomia results in a higher caries rate
- Xerostomia affects 30% of patients older than 65 years and up to 40% of patients older than 80 years
- 50% of persons aged older than 75 years of age have root caries affecting at least one tooth
- Cost of a 1 surface filling PPO \$80 – 100, Premier \$115 - 130
- Cost of a crown PPO \$650, Premier \$820

- <https://www.ada.org/en/member-center/oral-health-topics/xerostomia>
- <https://www.ada.org/en/member-center/oral-health-topics/aging-and-dental-health>

Pregnancy

- Low Term Birth Weight
- Pre-Term Delivery
- Pregnancy Tumor (Pyogenic Granulomas)



Oral Squamous Cell Carcinoma

- 52% of people treated are unable to return to work (disabled)
- If caught early, the survival rate is 83%. If oral cancer is detected in its pre-cancerous stage, the disease can be prevented
- \$100,000—one of the costliest cancers to treat



Home.remedydaily.com

Markopoulos AK. Current aspects on oral squamous cell carcinoma. *Open Dent J.* 2012;6:126-30.

Irani S. Distant metastasis from oral cancer: A review and molecular biologic aspects. *J Int Soc Prev Community Dent.* 2016;6(4):265-71.

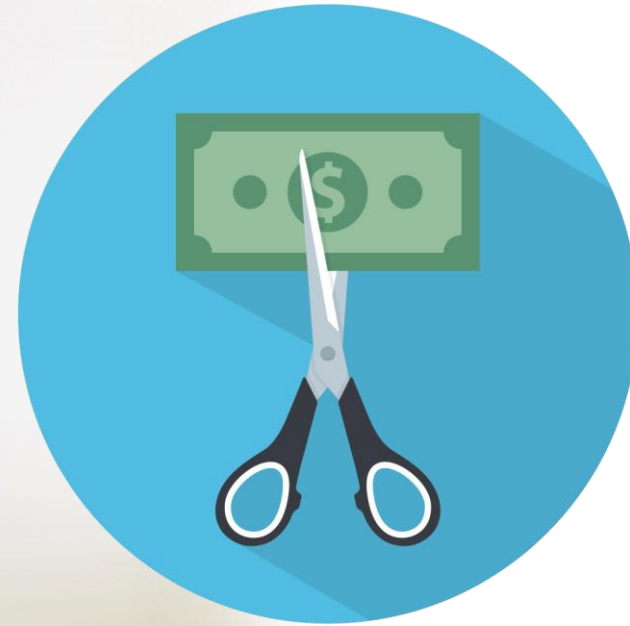
Shah JP, Gil Z. Current concepts in management of oral cancer: surgery. *Oral Oncol.* 2009;45:394–401.

Aspiration Pneumonia

- Periodontal (Gum) disease increases the risk of aspiration pneumonia four times
- Professional cleaning reduces risk between 50–67%
- Costs of treatment (\$6,000–\$40,000)
[\$14,000] median



Improving Oral Health Yields Lower Medical Costs



University of Michigan/Delta Dental

- 2,000 member group—gum disease/diabetes
- Medical and pharmaceutical costs
 - Two cleanings per year—19 percent reduction
 - More than two cleanings per year—28 percent reduction

Is There Scientific Evidence That Gum Disease Increases Medical Costs?

Aetna/Columbia

- Diabetes = \$0.27 pmpm
- Coronary artery disease = \$0.37 pmpm
- Stroke = \$0.44 pmpm

Albert DA, et al. An examination of periodontal treatment and pmpm medical costs in an insured population. BMC Health Services Research, 2006.

Is There Scientific Evidence That Gum Disease Increases Medical Costs?

Cigna/Penn

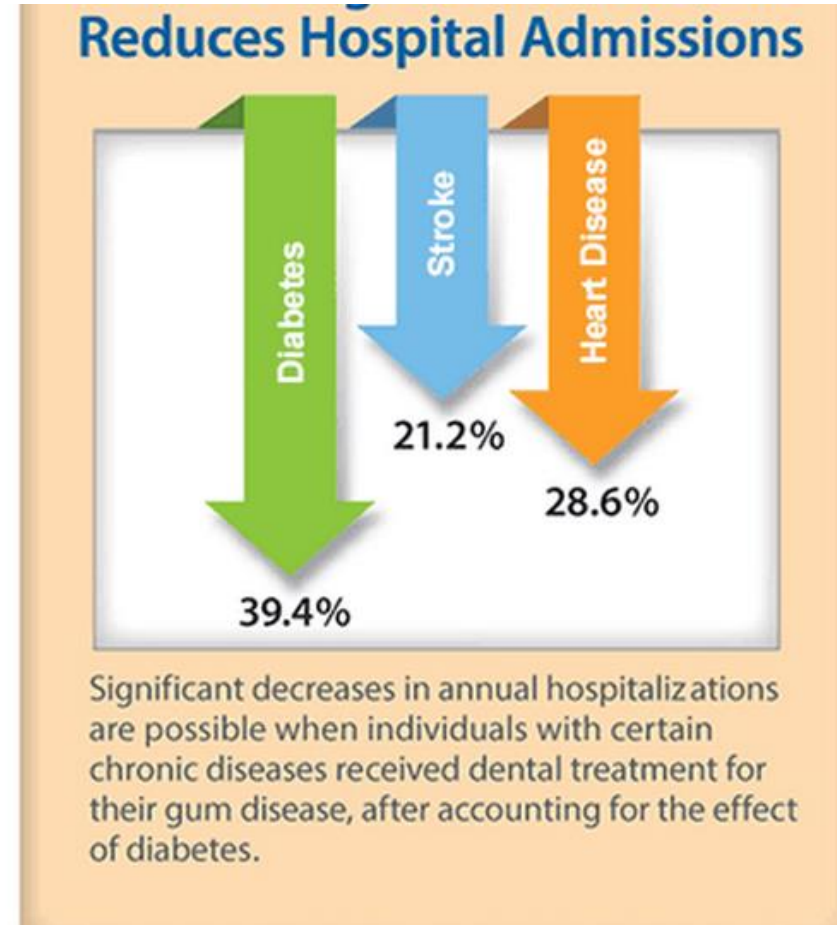
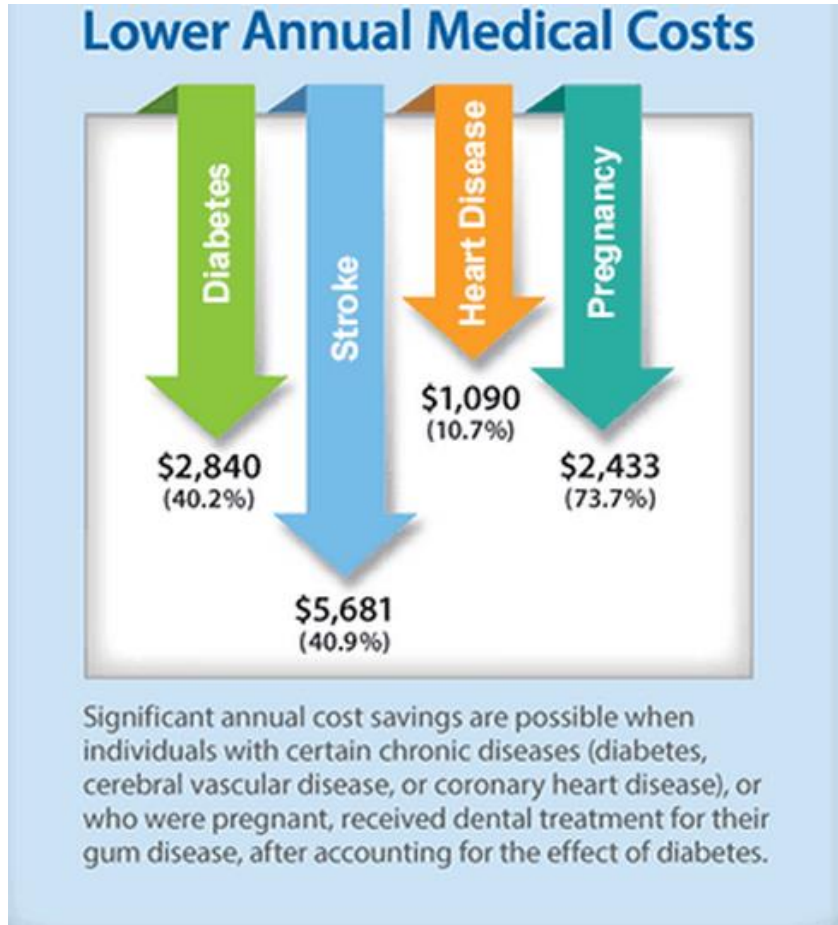
- Stroke = \$10,000/year less
- Diabetes = \$1,418/year less

Is There Scientific Evidence That Gum Disease Increases Medical Costs?

- University of Michigan/BCBS
 - Overall medical and pharmacy costs lowered by 10 percent in treatment group
 - 19 percent reduction in diabetes-related medical costs

Can Treatment of Gum Disease Reduce Medical Costs?

Jeffcoat et al AADR 2014



Can early dental care result in less medical costs?

- Observational study using Medicaid claims (2000–2006)
- 209,285 Medicaid enrolled children at age 6 months.
- IMB program improved dental health outcomes for Medicaid-enrolled children with a 32% chance of cost-saving

Emergency Department Diversion

- 2 million ED visits per year costing \$2B (2020 Texas A&M University School of Public Health study)
- Emergency departments can't treat dental disease, 39% return for the same problem
- Rx Antibiotic / analgesic
- ER visit for dental pain are costly and can range from \$400 to \$1,500 compared to a \$90 to \$200 visit to a dentist
- Extreme cases of untreated dental infections have cost hundreds of thousands of dollars in hospitalization and some ended in death.
- Concern: over-prescribing of narcotic analgesics

Solutions

- Expansion of dental benefits (commercial and federally funded)
- Public Education: Go to the dentist for dental problems, not the ED
- Referral network for ED to send patients to dentists (EMR)

What Is Delta Dental Doing About All of This?

- Wellness programs
- Expanded benefits for at-risk populations
- Waiver of benefit limitations
- Patient education
- Notify dental offices of patients with expanded benefits that have not been seen

Expanded Benefits for Special Needs Population

- Unlimited exams, desensitization
- Silver Diamine Fluoride
- Up to 4 cleanings per year
- Case management / Tx delivery

Summary

- The mouth is connected to the body
- There are some associations between oral disease and overall health
- There are some cause and effect relationships between oral disease and overall health
- Control of chronic oral disease can yield lower health care costs
- Oral health is a component of overall health

What Can I Do to Save My Teeth?



- Floss and brush daily
- See your dentist regularly
- Mind your own business

Questions?

